$1.00

Simpson

INSTRUMENTS THAT STAY ACCURATE

FRANIC WO # 1794

OPERATOR'S MANUAL

MODEL 400
INSULATION TESTER

WARNING

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

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INSTRUMENTS THAT STAY ACCURATE

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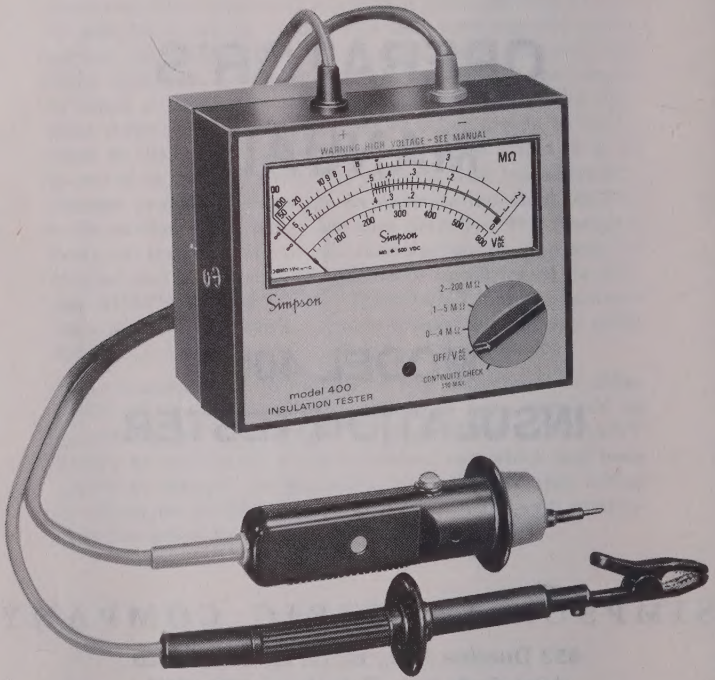

Figure 1-1. Simpson Model 400 Insulation Tester

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WARNING

This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson Model 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC microammeter and use this as the measuring instrument.

SECTION I

INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Model 400 (herafter referred to as Model 400 or simply as the Instrument), is a portable battery operated insulation tester, normally used for measuring the resistance of insulation in electrical appliances, switches, machines and equipment rated up to 500 volts. Often, Insulation resistance is a function of an applied voltage. The Model 400 differs from an ordinary high-range ohmmeter in that it actually applies a high voltage for the test. The Instrument is a rugged, high-performance, battery operated Insulation Tester, capable of making a wide variety of electrical measurements simply and accurately.

1.1.2 The Model 400 features, solid state circuit electronics and an accuracy of 1.5%. It allows measurements of DC and AC line voltages on a common linear scale and visual continuity checks (as specified in Table 1-1). These features, in combination with other functions and ranges, make the Model 400 an exceptional, general purpose portable Instrument . . . equally suitable for servicing, production, inspection and engineering applications.

1.1.3 A single range function selector switch and meter overload protection are provided. The use of a self shielding temperature compensated meter with pivoted springloaded jewel and a knife-edge pointer assures freedom from friction, excellent readability, resolution, and repeatability over a wide temperature range. A varistor in the meter circuit provides overload protection to the meter movement.

WARNING

While the internal resistance of the Instrument is sufficient to limit the short-circuit current between probes to less than 5 milliamperes, careless usage, nevertheless, can cause an electrical shock. The shock itself might be only moderate; however, it can cause a muscular reaction which can result in bodily harm to the user and/or damage to the equipment.

1.2 DESCRIPTION

1.2.1 The Model 400 is provided with a permanently attached negative test probe handle and a pendant positive alligator clip lead. The negative test probe has a pushbutton switch, an indicating lamp, and is terminated with a test prod. The pushbutton energizes the unit, and the lamp illuminates to indicate that the Instrument is ready for use. At the same time, the lamp provides convenient illumination at the testing point.

1.2.2 For insulation tests, the overall coverage of the Model 400 is divided into three overlapping ranges which are selected by a four-position rotary range selector switch. Located to the left of the range selector switch is a phenolic slotted screw used to adjust the meter pointer to mechanical zero (no input signal applied).

1.2.3 On each side of the Instrument is a strap attachment used to attach a strap for carrying purposes. Two captivated screws on the rear compartment are provided to facilitate its removal for replacement of the six 1.5-volt batteries.

1.3 OPERATING ACCESSORIES

All supplies and accessories required for the operation of the Model 400 are listed in Section VI. The 1.5-volt batteries are supplied with the Instrument.

1.4 TECHNICAL DATA

Table 1-1 lists the technical specifications for the Simpson Model 400 Insulation Tester.

Table 1-1. Technical Data

1. Voltage Ranges:	
AC, DC	0-600
Accuracy	±1.5% of full scale
2. Internal Resistance:	
AC	208kΩ
DC	231kΩ
3. Accuracy:	±1.5% of full scale length for battery voltage from 5-10 VDC on all resistance ranges.
4. Movement:	Moving coil movement with core magnet, shock resistant with spring loaded jewels.

5. Megohms Ranges:	
Range I	0-.4MΩ
Open circuit voltage	650 V
Internal resistance	250kΩ
Measuring voltage	0-400V
Range II	.1 to 5MΩ/∞
Open circuit voltage	650V
Internal resistance	150 kΩ
Measuring voltage	260 to 605V
Range III	2 to 200MΩ/∞
Open circuit voltage	650V
Internal resistance	150 kΩ
Measuring voltage	605 to 650V
6. Lamp Operating Point:	1M
7. Continuity Range:	
Operating Point of Lamp	0-500Ω
Open Circuit	5V DC
Internal Resistance	Approx. 1kΩ
8. *Rated Circuit-To-Ground Voltage:	a. Resistance Measurement: 500 VDC (Model 400 internal voltage only) b. Voltage Measurement: 600V RMS
9. Power Requirements:	9V DC supplied by six 1.5-volt batteries, "D" size
10. Negative Lead Characteristics:	
Negative Lead	Pushbutton switch
Lamp	Lens Type, 2.25V DC No. 222 and Probe
Positive Lead	Alligator clip on test probe
Length	Approx. 40" (1M.)
11. Instrument Dimensions:	5.6" high, 4.6" wide, 3.1" deep (141 x 117 x 80 mm)
12. Weight:	3 lbs. (1.4 kg.)

*Per ANSI C-39.5-1974: The specified voltage with respect to ground which may be safely and continuously applied to the circuits of an Instrument.

SECTION II

INSTALLATION

2.1 UNPACKING AND INSPECTION

2.1.1 Examine the shipping carton for signs of damage prior to unpacking. If there is none, then unpack and inspect the Instrument for possible damage in shipment. Check the electrical performance as soon as possible. If damage is apparent, notify the carrier and supplier before using the Instrument. Examine the physical condition of the positive cable and the negative test probe. Also check that all items are included (Table 6-1).

2.1.2 Save the shipping carton and packing materials for future storing or shipping of the Instrument.

2.1.3 The Model 400 is equipped with a permanently attached set of leads. The positive cable and test prod is supplied with an alligator clip, which can be exchanged for a standard insulating probe (see Table 6-2).

2.2 POWER SOURCE REQUIREMENTS

The Model 400 is designed to operate from its self-contained six 1.5-volt batteries (furnished with Instrument). Replacement batteries (refer to Table 1-1, item 9), can be purchased from any local electronic parts distributor. For battery installation and battery test refer to paragraph 2.5.

2.3 INSTALLATION

The Instrument may be operated in any position, wherever the associated equipment is to be tested, as long as the Instrument is placed on a suitable stable surface.

2.4 REAR COMPARTMENT REMOVAL

CAUTION

The rear compartment has two quick-disconnect banana type plugs which insert into the connectors located in back of the front panel section. These connectors provide a tight fit between the two sections. Consequently, when the rear com-

partment is removed, care must be taken to separate the two sections without causing the batteries to fall out.

a. Loosen the two captivated screws on the rear compartment.

b. Carefully hold the rear compartment and separate both sections, using a firm but minimum force.

2.5 BATTERY INSTALLATION

a. Remove the rear compartment as instructed in paragraph 2.4 above.

b. Install six 1.5-volt batteries in the rear compartment, in their respective location (refer to Figure 2.1). Observe that the negative (−) side of each battery points toward the retaining springs in the rear compartment.

c. Carefully place the front panel section onto the rear compartment, making sure that the banana connectors insert properly into their mating connectors in the front panel section.

d. Tighten the two captivated screws.

2.6 CHECKING MECHANICAL ZERO

Place the Model 400 in a horizontal position. The pointer must come to rest exactly at zero or at the infinity mark (∞), on the megohm scale. If the pointer does not rest on the infinity mark at extreme left end of the scale, turn (with screwdriver) the mechanical "zero" adjustment screw on the front of the Instrument, in the direction that will bring the pointer to rest at zero.

2.7 CHECKING ELECTRICAL ZERO

Turn the range selector switch to the 0-.4MΩ position. Short the two leads together, then operate the pushbutton on the negative test probe. The pointer must move from left to right and stop at the black mark indicating 0 MΩ at the right side of scale.

a. If the pointer fails to reach the black sector on the right side of the scale, an electrical zero adjustment must be made (refer to paragraph 2.8).

b. If the pointer still does not reach this sector, the battery voltage is too low, and the batteries must be replaced.

2.8 ELECTRICAL ZERO ADJUSTMENT

a. Remove the rear compartment from the front panel section (refer to paragraph 2.4).

b. Below the negative connector (in the front panel section, refer to Figure 2-1) is an access opening to the adjusting potentiometer.

c. Remove the small rubber plug cover. The potentiometer can now be adjusted using a small screwdriver.

NOTE: This adjustment can be made only with the rear compartment removed, and therefore is a trial and error procedure, in which case, the adjustment will have to be repeated.

d. Clockwise adjustment of the potentiometer moves the pointer to the left, and CCW adjustment moves the pointer to the right. After each adjustment, place the front panel section onto the rear compartment, making sure the banana plugs insert properly into the connectors.

e. Short the leads together, then operate the pushbutton in the negative test probe to check the pointer position.

f. Repeat the adjustment procedure until pointer is adjusted properly.

g. Reinstall the rubber plug cover, and reassemble the rear compartment onto the front panel section. Thighten the captivated screws securely.

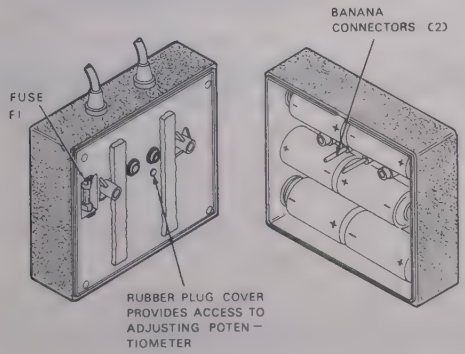

Figure 2-1. Front Panel Section and Rear Compartment View

SECTION III

CONTROLS, CONNECTORS AND INDICATORS

3.1 GENERAL

All operating and adjustment controls, connectors and indicators (refer to Figure 3-1, unless otherwise noted), are described in Table 3-1. Become familiar with each item prior to operating the Instrument for the first time.

Table 3-1. Controls, Connectors and Indicators

1. Range Selector Switch:

Switch Position	Description
CONTINUITY CHECK 500 MAX.	Selects continuity measurement from 0-500Ω maximum.
OFF/V AC DC	Selects voltage measurements from 0-600 volts AC or DC.
0-.4 MΩ	Selects first segment megohm range scale with resistance values and provides zero adjustment.
.1-5 MΩ	Selects second segment megohm range scale with resistance values.
2-200 MΩ	Selects third outermost segment megohm range scale.

2. Strap Holders: Used to secure the strap for carrying purposes.

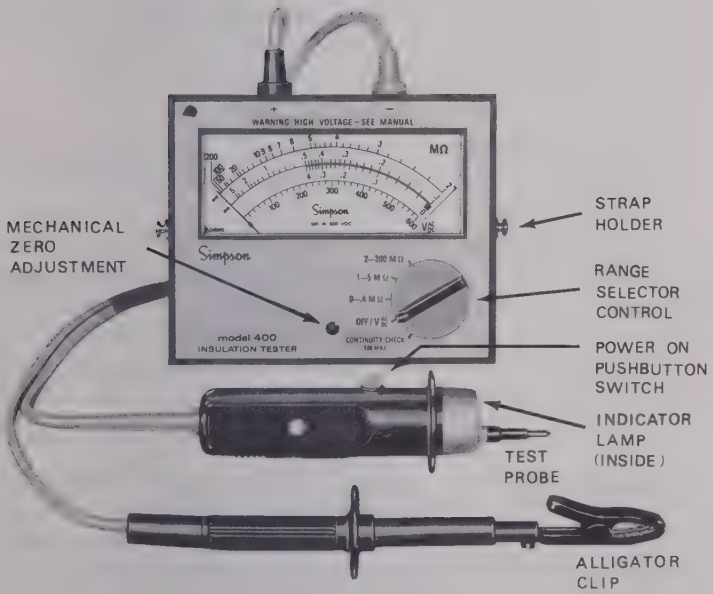

Figure 3-1. Model 400 Controls, Connectors and Indicators

3. Mechanical Zero Adjustment:	This phenolic screw is used to adjust the meter pointer to mechanical zero (no input signal applied).
4. "+" and "−" Connectors: (Inside, on rear of front panel section)	Used to make interconnection with positive and negative banana plugs on rear compartment section.
5. Adjusting Potentiometer: (Inside front panel section, located below connector)	Used to perform electrical zero adjustment.
6. Positive and Negative Banana Plugs: (Inside, on rear compartment)	Used to make interconnection with "+" and "−" connectors in rear of front panel section.
7. Negative Test Probe: Pushbutton Switch	Used to apply battery power to the Instrument, thereby generating the high voltage used for test, and causing the indicator lamp in the negative test probe to illuminate. This arrangement ensures that current is drawn from the batteries, and the high voltage prevails, only for the duration of a measurement.
Indicator Lamp	Illuminates upon actuation of the pushbutton switch, to indicate that the Instrument is ready for use. This indicator lamp, which is built into the negative test probe, goes out whenever the insulation resistance is lower than approximately 1 MΩ.
Test Probe	Used to connect to the negative test point (at different location) for measuring purposes.
8. Positive Alligator Clip Lead:	Used to secure lead to the positive test lead or wire (at different locations) for measuring purposes.

SECTION IV

OPERATION

4.1 GENERAL

WARNING

The Model 400 is designed to prevent accidental shock when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read completely prior to making any measurements. Failure to do so can result in a serious or fatal accident.

This section of the manual contains information required to use and operate the Model 400 in a safe and proper manner.

4.2 SAFETY PRECAUTIONS

4.2.1 The Model 400 is designed to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury. Refer to SHOCK HAZARD definition on page iv.

4.2.2 Do not work alone when making measurements where a shock hazard can exist. Notify another nearby person that you are, or intend to make such measurements.

4.2.3 Remember, voltages might appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor's retaining a dangerous charge. Remove all power and discharge all capacitors in the circuit being measured and remove all power from the Model 400 before making connections or disconnections.

4.2.4 Locate all voltage sources and accessibility paths prior to making any measurements or connections.

4.2.5 Inspect the test leads for cracks, breaks or crazes in the insulation, prods, and connectors before each use. If any defects are noted, replace the test leads immediately.

4.2.6 Do not make measurements in a circuit where corona is present. Corona can be identified by a pale-blue color emanating from sharp metal points in the circuit or a buzzing sound, or the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily, the presence of ozone indicates presence of high voltage, and probably a malfunction of some kind.

4.2.7 Hands, shoes, floor and workbench must be dry. Avoid making measurements under humid, damp, or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or the Instrument.

4.2.8 For maximum safety, do not touch test leads, circuit, or Instrument while power is applied to the circuit being measured.

4.2.9 Use extreme caution when making measurements in an rf circuit where dangerous composite voltages could be present, such as in a modulated rf amplifier.

4.2.10 Do not connect the test leads of the Model 400, to any circuit having a voltage (with respect to ground) that exceeds the rated circuit-to-ground voltage as indicated in Table 1-1. Exceeding this voltage can result in insulation failure, harmful to the Instrument and possibly result in a shock hazard to the operator.

4.3 PRINCIPLES OF OPERATION

4.3.1 Power Supply

a. The high test voltage of the Model 400 is generated by a transistor-oscillator power supply which receives its operating power from the six batteries in the rear compartment. An automatic control circuit holds the high test voltage source stable.

b. During zero adjustment, with the test leads shorted and the pushbutton switch depressed, the meter indication is then adjusted to full scale mark (zero resistance) by use of the adjust zero potentiometer (refer to Figure 2-1). The current flowing in

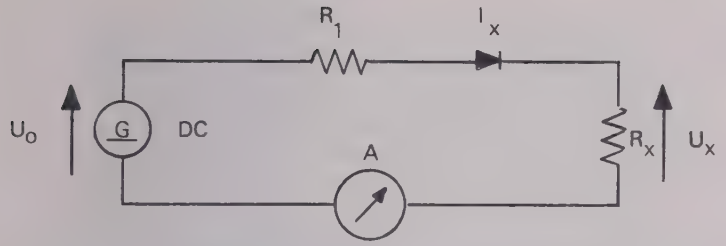

Figure 4-1. Metering Circuit

the metering circuit (refer to Figure 4-1) will now be determined by the value of the unknown insulation resistance R_x. Therefore, the meter deflection will indicate the insulation resistance value directly in terms of MΩ.

c. Assuming a constant open circuit voltage U_o and a given internal resistance R_i, the current indicating instrument A depends on the resistance R_x of insulation under test. The test voltage U_x can be calculated from formula

$$U_x = U_o \frac{R_x}{R_x = R_i}$$

where

U_o = Open Circuit Voltage 650V
R_i = .25MΩ for Range I
R_i = .15MΩ for Ranges II and III

and the values of U_x obtained as a function of R_x. Graphical illustration below (Figure 4-2) is provided for checking calculated results.

d. Example:

The above insulation resistance of a comsumer's system must be above 1kΩ per volt of working voltage, per 100 meters of line length; e.g., 380 kΩ for a working voltage of 380 volts. The output of the Model 400 will measure a length of line exceeding 100 meters at a working voltage of 240 volts. To calculate

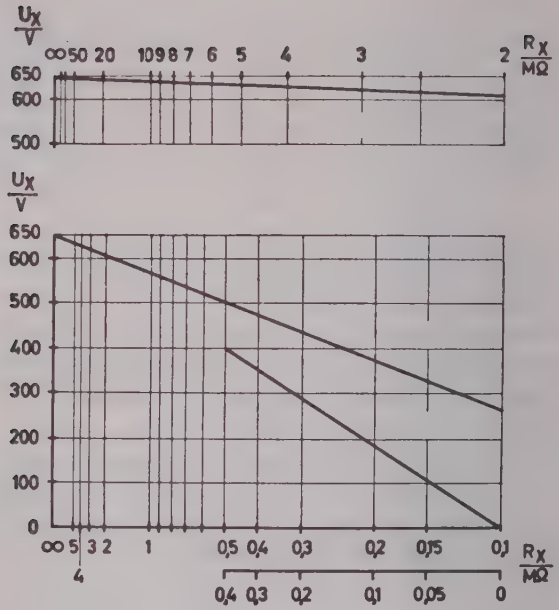

Figure 4-2. Test Voltage Graph

the test voltage value U_x for a resistance of 240 kΩ, use the formula:

$$U_x = U_o \frac{R_x}{R_x + R_i} = 650 \frac{240k\Omega}{240k\Omega + 250k\Omega} = 318.4 \text{ V}.$$

Thus the test voltage is 318.4 volts.

4.4 INSULATION RESISTANCE MEASUREMENTS

4.4.1 Checking for Voltage

a. Prior to making measurements, review and comply with the SAFETY PRECAUTIONS listed in paragraph 4.2.

ation

b. Check the cable coil circuit before making any resistance measurements to determine that no voltage is present. In order to avoid inaccurate reading due to voltage, and for safety purposes, always set the range selector switch to OFF position and discharge the circuit. Observe the discharge process which occurs when the indicating pointer fully comes to rest at the zero mark.

c. After the resistance check has been made, set the range selector switch to the OFF position in order to discharge the circuit. Observe that the indicating pointer confirms that the discharge is complete.

4.4.2 Checking for Resistance

a. Set the range selector switch to the 0-.4mΩ position and verify electrical zero with both terminals short circuited. Never measure resistance, if there is the slightest indication of a voltage potential (refer to paragraph 4.6).

WARNING

Do not touch both lead ends with fingers if pushbutton switch in negative test probe is depressed, because an open circuit voltage of 650V is present.

b. Set the range selector switch to the 0-.4MΩ position and short the negative and positive test leads to verify electrical zero.

c. Check the resistance of the unit under test, using the lowest range. If the resistance is higher, Range II or III must be selected.

d. Depress the pushbutton switch on the negative test probe, for approximately 60 seconds, and observe the Instrument reading.

e. For reference purposes, keep a complete record of temperature and humidity in order to maintain suitable test conditions when equipment is periodically tested.

f. For safety precautions, set the range selector switch to the OFF position in order to discharge the circuit. This safety step **must always** be performed at end of test. Observe that indicating pointer indicates the progress of the discharge.

g. Disconnect the negative and positive test leads from the equipment under test.

4.5 VISUAL INSPECTION TEST

NOTE: The visual inspection test is intended for use **only** when accurate determination of the insulation resistance is not required. The measuring Instrument checks whether the insulation resistance is above 1 MΩ at 500 volts DC. This method is particularly useful for checking circuits on an assembly line or incoming inspection basis.

a. With the range selector switch set to any of the MΩ positions, connect the negative and positive test leads to the device to be tested.

b. Depress the pushbutton switch on the negative test probe. The indicator lamp in the negative test probe will remain lighted if the insulation resistance is over 1 MΩ. If the lamp goes out, the insulation resistance of the device under test is less than 1 MΩ.

c. For a more accurate determination of a resistance test, perform the procedure in paragraph 4.4.

d. For safety precautions, set the range selector switch to the OFF position in order to discharge the circuit. This safety step **must always** be performed at end of test. Using the voltmeter, observe the completion of the discharge.

4.6 VOLTAGE MEASUREMENT

CAUTION

The Model 400 can measure AC and DC external voltages to a maximum of 600 volts.

The Model 400 Insulation Tester can be used to measure both DC and AC voltages on a common scale when the switch is set to the

OFF position. Since external voltages are being measured, the pushbutton switch on the negative test probe does not have to be used, and has no effect upon the measurement or its accuracy.

a. Prior to making measurements, review and comply with the SAFETY PRECAUTIONS listed in paragraph 4.2.
b. Connect the negative and positive test leads to the voltage source.
c. The indicating pointer will indicate the voltage between the points under test. DC voltages will be read correctly, independent of the polarity of the voltage supply.

4.7 CONTINUITY TEST

NOTE: Never perform a continuity measurement if there is the slightest indication of a voltage potential in the unit under test. A voltage check can be made by performing the test procedure given in paragraph 4.6.

a. Set the range selector switch to the CONTINUITY CHECK 500 MAX. position.
b. Connect the negative and positive test leads to the wires or circuit to be tested, making sure no voltage is present.
c. Press the pushbutton switch on the negative test probe. The lamp will go out if continuity exists. Typically, the detection is 0 to 500.

4.8 PROTECTION OF "CONTINUITY" CIRCUIT

The continuity range circuitry (refer to Figure 6-1), is protected by a medium acting 50mA fuse to prevent damage, should a voltage be accidentally connected to the Instrument with the range selector switch in the continuity position. If the fuse has blown (is open) the Instrument remains operational on all other ranges.

4.9 APPLICATION INFORMATION

4.9.1 General

The basic principles for testing the insulation resistance of every component, or major types of equipment is for all practical purposes the same. Where periodic checks are made, keep records for comparison, to assure the repetitive tests are always conducted in the same manner. **Always** make certain the wiring or equipment is de-energized. The following examples are but a few of the many components where insulation resistance tests can be made.

4.9.2 Switches

Careful attention should be paid to the wide variety of switches and their various types of insulation. Check insulation resistance from ground to terminals and between terminals.

4.9.3 Appliances

Insulation testing insures against possible home accidents, fire hazards and overall factory accidents. Before checking an appliance for resistance, make sure that the power source to that appliance is disconnected.

4.9.4 AC Motors

To check insulation resistance on disconnected motors, connect the negative test lead to the motor frame, and the positive alligator clip to the motor leads.

4.9.5 DC Motors

The overall resistance of all the components of a DC motor can be checked by measuring the resistance between ground and the brush mechanism. To measure the insulation resistance of the armature or field alone, remove the brushes from the commutator ring. The field is checked by measuring between the frame ground and the brushes. The armature is checked by measuring between rotor laminations and the commutator segments.

4.9.6 Transformers

Test the disconnected transformer by connecting the positive alligator clip to either the primary or secondary winding, and the negative test probe to ground. Also check resistance between primary and secondary winding.

4.9.7 Flooded Equipment

Check any type of equipment which has been subjected to water immersion, after making sure that such equipment is thoroughly dry and clean. Check the equipment records (if available), to compare present test results, with the figures recorded prior to the flood damage.

SECTION V

MAINTENANCE

5.1 GENERAL

The Simpson Model 400 is carefully designed and constructed with high quality components. By providing reasonable care, and following the instructions in this manual, the user can expect a long service life.

5.2 WARRANTY

5.2.1 The Simpson Electric Company warranty policy is printed on the inside cover of this manual. Read it carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center listed on the last pages of this manual or contact the Factory Service Manager. Give full details of the difficulty and include the model and serial number of the unit and date of purchase. Shipping instructions will be promptly sent to you. If an estimate of charges for non-warranty work or other service work is required, a firm quote estimate will be furnished upon receipt of the unit. Service work will not be performed without customer approval.

5.3 SHIPPING

Pack the Instrument carefully, less batteries, and ship prepaid to the destination indicated. Insure the Instrument.

5.4 BATTERY AND/OR FUSE REPLACEMENT

a. To replace the batteries, refer to paragraph 2.5.

b. To replace the fuse, remove the rear compartment as instructed in paragraph 2.4.

CAUTION

Replace fuse with exactly the same type fuse.

c. Replace the defective fuse with a medium acting 50 mA fuse, (refer to Replacement Parts List).

d. Re-install the rear compartment (refer to paragraph 2.5, steps c and d).

5.5 INDICATOR LAMP REPLACEMENT

a. Carefully unscrew the test probe on the negative test lead and take the plastic cap off the handle.

b. Replace the lens type lamp in its threaded socket with an equivalent.

c. Re-install the plastic cap, together with the test probe, into the handle. Make sure the plastic cap fits properly into the key inside handle. Tighten the test probe securely.

SECTION VI

ORDERING INFORMATION AND AUTHORIZED SERVICE CENTERS

Table 6-1. Items Furnished With Instrument

Quantity	Description	Part No.
1	Model 400 Insulator Tester, complete with two permanently attached test leads	12501
1	Carrying Strap	
6	Battery, 1.5 Volt NEDA 13C "D" size	1-118722
1	Operator's Manual	5-116338

Table 6-2 Accessories and Replacement Parts

Description	Part No.
Carrying Case	Cat. No. 01615
Fuse, medium acting 50 mA	G0-000688
Battery, 1.5V NEDA 13C "D" size	1-118722
Lamp, 2.25V lens type No. 222	5-116607
Operator's Manual	5-116338
Insulated Probe Tip & Alligator Clip Kit	Cat. No. 00737

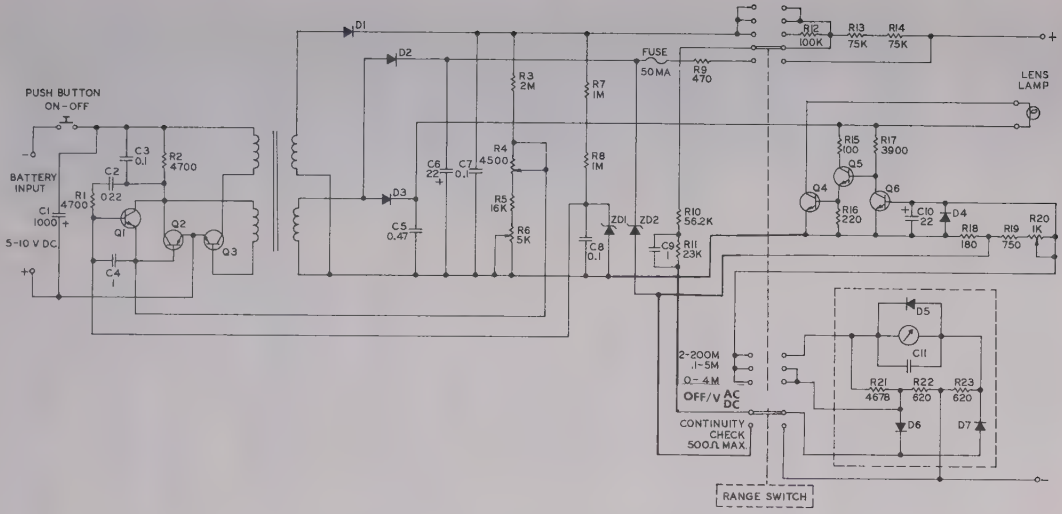

Figure 6-1. Model 400, Schematic Diagram

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★ALASKA, ANCHORAGE 99500
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